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Big bounce with finite-time singularity: The F (R) gravity description

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Abstract

© 2017 World Scientific Publishing Company. An alternative to the Big Bang cosmologies is obtained by the Big Bounce cosmologies. In this paper, we study a bounce cosmology with a Type IV singularity occurring at the bouncing point in the context of F(R) modified gravity. We investigate the evolution of the Hubble radius and we examine the issue of primordial cosmological perturbations in detail. As we demonstrate, for the singular bounceG, The primordial perturbations originating from the cosmological era near the bounce do not produce a scale-invariant spectrum and also the short wavelength modes after these exit the horizon, do not freeze, but grow linearly with time. After presenting the cosmological perturbations study, we discuss the viability of the singular bounce model, and our results indicate that the singular bounce must be combined with another cosmological scenario, or should be modified appropriately, in order that it leads to a viable cosmology. The study of the slow-roll parameters leads to the same result indicating that the singular bounce theory is unstable at the singularity point for certain values of the parameters. We also conformally transform the Jordan frame singular bounce, and as we demonstrateG, The Einstein frame metric leads to a Big Rip singularity. ThereforeG, The Type IV singularity in the Jordan frame becomes a Big Rip singularity in the Einstein frame. Finally, we briefly study a generalized singular cosmological model, which contains two Type IV singularities, with quite appealing features.

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Keywords

bouncing cosmologies, F (R) gravity, finite time cosmological singularities, Modified gravity

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